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09/943,955	08/31/2001	Arulkumar P. Shanmugasundram	5918/04/FPS/MMCS/APC/DV	2623

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EXAMINER

UMEZ ERONINI, LYNETTE T

ART UNIT PAPER NUMBER

1765

DATE MAILED: 12/30/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/943,955

Applicant(s)

SHANMUGASUNDRAM ET AL

Examiner

Lynette T. Umez-Eronini

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 1 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 20 September 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-27 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-17 and 21-24 is/are rejected.
- 7) ☒ Claim(s) 18-20 and 25-27 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 12/7/4, 10/6/4 & 8/11/4
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1, 3-5, 14, 15, 16, 17; 2; and 21-24 are rejected under 35 U.S.C. 102(b) as being anticipated by Wiswesser et al. (US 6,159,073).

Wiswesser teaches a method of measuring substrate layer thickness during chemical mechanical polishing (column 1, lines 7-10). The method comprises measuring a characteristic of a layer on a substrate during chemical mechanical polishing. The characteristic may be an initial thickness of the substrate layer. A measure of polishing uniformity may be calculated from the measured characteristic in each radial range. A model function may be determined for each radial range (column 2, line 42 – column 4, line 1). Wiswesser further teaches, "The thickness of a substrate layer on a blank wafer may be measured in-situ at a plurality of radial positions in order to generate a measure of the polishing uniformity to characterize the effectiveness of the CMP tool and process. The thickness measurements may be used to determine the endpoint criteria or to adjust polishing parameters to improve polishing uniformity. The thickness measurements may also be performed when polishing a device wafer to detect the polishing endpoint" column 3, line 64 – column 4, line 5; column 7, lines 1-9; and column 8, lines 50-55). The aforementioned reads on,

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A method of producing a target wafer thickness profile in a polishing operation, comprising:

a) providing a model for a wafer polishing that defines a plurality of substantially annular regions on a wafer and identifies a wafer material removal rate in a polishing step for each of the regions; and

(b) polishing a wafer using a polishing recipe that generates a target thickness profile for each region, **in claims 1, 3-5, and 14-17**;

A method of controlling surface non-uniformity of a wafer in a polishing operation, comprising:

a) providing a model for a wafer polishing that defines a plurality of regions on a wafer and id a plurality of polishing steps and identifies a wafer material removal rate in a polishing step of a polishing process for each of the regions steps;

b) polishing a wafer using a first polishing recipe;

c) determining a wafer thickness profile for the post-polished wafer of step (b);

and

d) calculating an updated polishing model based upon the wafer thickness profile of step (c) and the model of step (a) and updating the first polishing recipe based on the updated model to maintain a target wafer thickness profile, **in claim 2**; and

A method of determining a model for wafer thickness profile, comprising:

(a) measuring pre-polished wafer thickness in a region defined on one or more wafers;

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(b) polishing the one or more wafers, wherein polishing comprises polishing the one or more wafers in a plurality of polishing steps;

(c) measuring the wafer material removal rate for the one or more wafers at each of the plurality of regions after each of the polishing steps of step (b);

(d) providing a model defining the effect of tool state on polishing effectiveness;
and

(e) recording the pre-polished and post-polished wafer thicknesses for each of the regions on a recordable medium, **in claims 21-24.**

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

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5. Claims 6-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wiswesser (US '073), as applied to claim 1 above.

Wiswesser differs in failing to specify the number and type of polishing stations used in the polishing step.

It would have been obvious to one having ordinary skill in the art of the time of the claimed invention to employ known methods of polishing a wafer in a polishing station as well as in a plurality of polishing stations as claimed by applicants for the purpose of speeding up the step of polishing semiconductor wafers.

Response to Arguments

6. Applicant's arguments with respect to claims 1-27 have been considered but are moot in view of the new ground(s) of rejection because a method of providing a target thickness profile in a polishing operation, comprising; (a) providing a model for wafer polishing that defines a plurality of substantially annular regions on a wafer and identifies a wafer material removal rate in a polishing step for each of the regions; and a method of controlling surface non-uniformity of a wafer in a polishing operation, comprising: providing a model for wafer polishing that defines a plurality of regions on a wafer and identifies a wafer material removal rate in a polishing step for each of a polishing process for each of the regions steps, as recited respectively in claims 1 and 2, which was not taught by the former prior art of record.

Allowable Subject Matter

7. Claims 18-20, and 25-27 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

8. The following is a statement of reasons for the indication of allowable subject matter:

As to claims 18-20, the prior art of record taken alone or in combination fails to suggest, teach, or render obvious a method of producing a target wafer thickness profile in a polishing operation, wherein the wafer removal for a region j (AR'_j) in the model of step (a) is determined according to the equation as recited in claim 18, and in combination with the rest of the limitations of the said claims.

As to claims 25-27, the prior art of record taken alone or in combination fails to suggest, teach, or render obvious a method of determining a model for wafer thickness profile comprising: wherein the wafer removal for a region j (AR'_j) in the model of step (a) is determined according to the equation as recited in claim 25 and in combination with the rest of the limitations of the said claims.

Conclusion

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

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A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lynette T. Umez-Eronini whose telephone number is 571-272-1470. The examiner is normally unavailable on the First Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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LAN VINH
PRIMARY EXAMINER

A handwritten signature in black ink, appearing to read 'Lan Vinh', written over the printed name and title.

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December 27, 2004